

Large-Area, UV-Optimized, Back-Illuminated Silicon Photomultiplier Arrays, Phase II

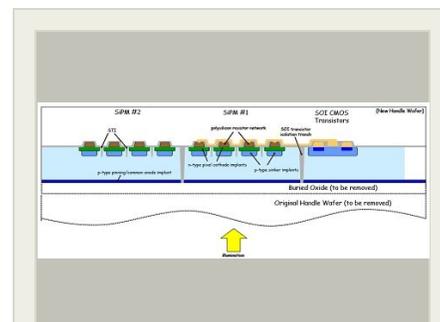
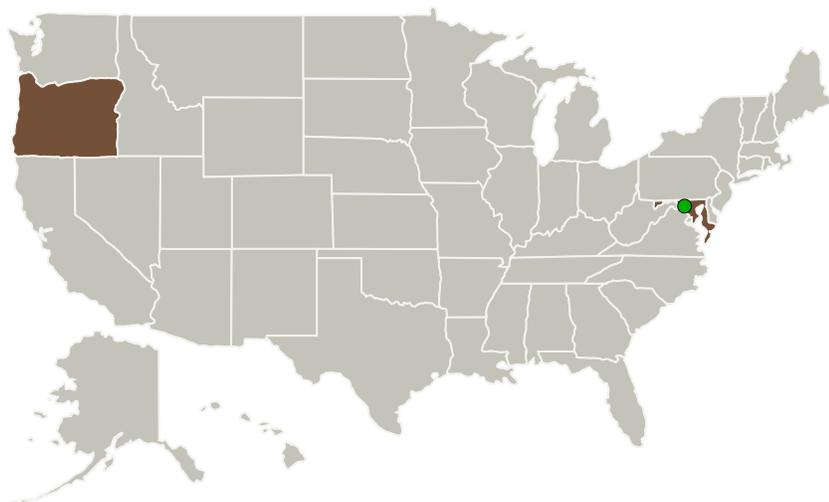
Completed Technology Project (2012 - 2018)



Project Introduction

Large-area (3m²), UV-sensitive focal plane arrays are needed for observation of air showers from ultra-high energy cosmic rays (JEM-EUSO) as well as for visible-wavelength spectrographic and photometric instruments planned for future telescopes (OWL). Existing photocathode-based technologies for visible and UV instruments lack sensitivity, are bulky, and have limited reliability. Solid-state silicon photomultipliers (SiPMs) are efficient, light, and reliable, but the front-illuminated designs demonstrated to date have poor UV response, limited sensitive area and optical fill-factor. To solve the above problems, a large-area, back-illuminated silicon photomultiplier (BaSiPM) array technology has been developed. The BaSiPM technology will integrate SiPM pixel arrays, fabricated on domestic, large volume commercial CMOS fab, with wafer-scale thinning. Short-wavelength light is absorbed near the surface of a silicon detector, and moving the optical entry surface to the back side of the wafer enhances UV response by ensuring that all photo-carriers are generated on the correct side of the junction for efficient avalanche multiplication. Placing the optical entry surface on the back of the wafer also improves the optical fill since it is no longer necessary to shine light through the quench resistor network on the front surface of the detector. Lastly, back-thinning the detector wafer significantly reduces the mass per unit area of the focal plane array. Voxel has successfully demonstrated the ability to perform wafer-scale back thinning fabrication for superior UV sensitivity. Three SiPM architectures (25 variations) have been characterized and studied in detail and their performance compared with commercially available SiPMs. The design of a large format focal plane design, including a mechanical model, mounting, and alignment will be developed using the proposed technology.

Primary U.S. Work Locations and Key Partners



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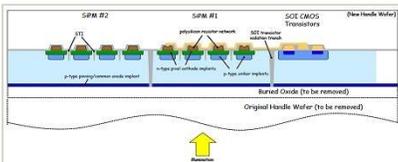
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Organizations Performing Work	Role	Type	Location
Voxel, Inc.	Lead Organization	Industry	Beaverton, Oregon
 Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	Oregon

Images



Briefing Chart Image

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 (<https://techport.nasa.gov/image/136952>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Voxel, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Vinit Dhulla

Co-Investigator:

Vinit Dhulla

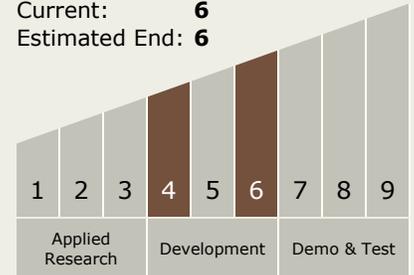
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Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System